

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant: Paul E. Christianson

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Examiner: NGUYEN, Tan Quang

Title: METHODS AND SYSTEMS FOR GENERATING A TERRAIN ELEVATION  
MAP IN A CARTESIAN FORMAT

**RESPONSE TO OFFICE ACTION**

TO THE COMMISSIONER OF PATENTS:

**AMENDMENT AND RESPONSE**

In the Claims:

1. (Canceled)
2. (Currently Amended): The method of Claim 48, further comprising saving the generated terrain elevation map in a database.
3. (Currently Amended): The method of Claim 48, further comprising:  
sending the generated terrain elevation map to a display processor; and  
generating a map image for display based on the sent terrain elevation map.
4. (Currently Amended): The method of Claim 48, further comprising sending the terrain elevation map to the navigation component, wherein the navigation component comprises a ground proximity warning component for generating one or more of a ground proximity caution or warning based on the received terrain elevation map.
5. (Currently Amended): The method of Claim 48, further comprising:  
sending the terrain elevation map to the navigation component;  
generating navigation signals at the navigation component based on the received terrain elevation map; and  
sending the generated navigation signals to one or more navigation units for presentation.
6. (Currently Amended): The method of Claim 48, further comprising sending the terrain elevation map to a radar system.
7. (Original): The method of Claim 6, further comprising generating a volumetric buffer based on the terrain elevation map and radar signals generated by the radar system.

8. (Currently Amended): ~~The method of Claim 1A~~ method for generating a terrain elevation map in proximity to a vehicle, the method comprising:

retrieving terrain elevation data based on aircraft position information generated by a navigation component; and

generating a Cartesian coordinate-referenced terrain elevation map based on the retrieved terrain elevation data and the aircraft position information received from the navigation component, wherein generating the terrain elevation map comprises:

initializing the terrain elevation map;

updating the initialized terrain elevation map; and

updating a rotation angle of the terrain elevation map.

9. (Original): The method of Claim 8, wherein initializing the terrain elevation map comprises:

setting a stabilized transform matrix equal to a north referenced transform matrix;

setting a rotation angle between a north referenced frame and a stabilized frame equal to zero;

calculating each position of the cells of an earth centered earth fixed referenced frame;

calculating latitude and longitude for each of the cells in the earth centered earth fixed referenced frame; and

mapping terrain elevation data into a terrain elevation map referenced to the stabilized frame based on the calculated latitude and longitude and the stabilized transform matrix.

10. (Original): The method of Claim 9, wherein updating the terrain elevation map comprises:

determining if the vehicle has moved a distance at least one of greater than or equal to a threshold amount; and

adding at least one other row or column of terrain elevation data to the terrain elevation map if the vehicle was determined to move at least one of greater than or equal to the threshold amount.

11. (Original): The method of Claim 9, wherein updating the rotation angle comprises:

determining incremental displacement values of the vehicle; and  
updating the rotation angle between the stabilized frame and the north referenced frame based on the determined incremental displacement values.

12. (Original): The method of Claim 11, wherein updating the rotation angle comprises generating a stabilized transform matrix based on the incremental displacement values.

13. (Canceled)

14. (Currently Amended): The product of Claim ~~13~~<sup>20</sup>, further comprising a component for saving the generated terrain elevation map in a database.

15. (Currently Amended): The product of Claim ~~13~~<sup>20</sup>, further comprising:  
a component for sending the generated terrain elevation map to a display processor;  
and  
a component for generating a map image for display based on the sent terrain elevation map.

16. (Currently Amended): The product of Claim ~~13~~<sup>20</sup>, further comprising a component for sending the terrain elevation map to the navigation component, wherein the

navigation component comprises a ground proximity warning component for generating one or more of a ground proximity caution or warning based on the received terrain elevation map.

17. (Currently Amended): The product of Claim 1320, further comprising:
  - a component for sending the terrain elevation map to the navigation component;
  - a component for generating navigation signals at the navigation component based on the received terrain elevation map; and
  - a component for sending the generated navigation signals to one or more navigation units for presentation.

18. (Currently Amended): The product of Claim 1320, further comprising a component for sending the terrain elevation map to a radar system.

19. (Original): The product of Claim 18, further comprising a component for generating a volumetric buffer based on the terrain elevation map and radar signals generated by the radar system.

20. (Currently Amended): The product of Claim 13A computer program product for generating a terrain elevation map relative to a vehicle, the product comprising:

- a component for retrieving terrain elevation data based on aircraft position information generated by a navigation component; and
- a component for generating a Cartesian coordinate-referenced terrain elevation map based on the retrieved terrain elevation data and the aircraft position information received from the navigation component, wherein the component for generating the terrain elevation map comprises:
  - a component for initializing the terrain elevation map;
  - a component for updating the initialized terrain elevation map; and
  - a component for updating a rotation angle of the terrain elevation map.

21. (Original): The product of Claim 20, wherein the component for initializing the terrain elevation map comprises:

- a component for setting a stabilized transform matrix equal to a north referenced transform matrix;
- a component for setting a rotation angle between a north referenced frame and a stabilized frame equal to zero;
- a component for calculating each position of the cells of a centered earth fixed referenced frame;
- a component for calculating latitude and longitude for each of the cells in the earth centered earth fixed referenced frame; and
- a component for mapping terrain elevation data into a terrain elevation map referenced to the stabilized frame based on the calculated latitude and longitude and the stabilized transform matrix.

22. (Original): The product of Claim 21, wherein the component for updating the terrain elevation map comprises:

- a component for determining if the vehicle has moved a distance greater than a threshold amount; and
- a component for adding at least one other row or column of terrain elevation data to the terrain elevation map if the vehicle was determined to move at least one of greater than or equal to the threshold amount.

23. (Original): The product of Claim 21, wherein the component for updating the rotation angle comprises:

- a component for determining incremental displacement values of the vehicle; and
- a component for updating the rotation angle between the stabilized frame and the north referenced frame based on the determined incremental displacement values.

24. (Original): The product of Claim 23, wherein a component for updating the rotation angle comprises a component for generating a stabilized transform matrix based on the incremental displacement values.

25. (Cancelled)

26. (Currently Amended): The system of Claim 2531, wherein the processor further comprises a component for saving the generated terrain elevation map in the memory.

27. (Currently Amended): The system of Claim 2531, further comprising:  
a display processor in communication with the processor, the display processor generates a map image.

28. (Currently Amended): The system of Claim 2531, wherein the navigation component comprises a ground proximity warning component for generating one or more of a ground proximity caution or warning based on the received terrain elevation map.

29. (Currently Amended): The system of Claim 2531, wherein the navigation component comprises:

a component for generating navigation signals based on the received terrain elevation map, and

a component for presenting at least a portion of the generated navigation signals.

30. (Currently Amended): The system of Claim 2531, further comprising a radar system for generating a volumetric buffer based on the terrain elevation map and radar signals generated by the radar system.

31. (Currently Amended): The system of Claim 25A system for generating a terrain elevation map relative to a vehicle, the system comprising:

memory for storing terrain elevation data;  
a navigation component for generating aircraft position information; and  
a processor in communication with the memory and the navigation component, the  
processor comprising:  
    a component for retrieving terrain elevation data from the memory based on  
    the generated aircraft position information; and  
    a component for generating a Cartesian coordinate-referenced terrain  
    elevation map based on the retrieved terrain elevation data and the aircraft  
    position information, wherein the component for generating the terrain  
    elevation map comprises:  
        a component for initializing the terrain elevation map;  
        a component for updating the initialized terrain elevation map; and  
        a component for updating a rotation angle of the terrain elevation map.

32. (Original): The system of Claim 31, wherein the component for initializing the terrain elevation map comprises:

- a component for setting a stabilized transform matrix equal to a north referenced transform matrix;
- a component for setting a rotation angle between a north referenced frame and a stabilized frame equal to zero;
- a component for calculating each position of the cells of a centered earth fixed referenced frame;
- a component for calculating latitude and longitude for each of the cells in the earth centered earth fixed referenced frame; and

a component for mapping terrain elevation data into a terrain elevation map referenced to the stabilized frame based on the calculated latitude and longitude and the stabilized transform matrix.

33. (Original): The system of Claim 32, wherein the component for updating the terrain elevation map comprises:

- a component for determining if the vehicle has moved a distance greater than a threshold amount; and
- a component for adding at least one other row or column of terrain elevation data to the terrain elevation map if the vehicle was determined to move at least one of greater than or equal to the threshold amount.

34. (Original): The system of Claim 32, wherein the component for updating the rotation angle comprises:

- a component for determining incremental displacement values of the vehicle; and
- a component for updating the rotation angle between the stabilized frame and the north referenced frame based on the determined incremental displacement values.

35. (Original): The system of Claim 34, wherein a component for updating the rotation angle comprises a component for generating a stabilized transform matrix based on the incremental displacement values.

## **REMARKS**

Claims 1-35 are pending. An Office Action mailed February 24, 2006 rejected Claims 1-7, 13-19, and 25-30 and objected to Claims 8-12, 20-24, and 31-35. By way of this Amendment, Applicant hereby cancels Claims 1, 8, and 20 and amends Claims 2-6, 8, 14-18, 20, and 26-31. Pursuant to 37 CFR § 1.111, Applicant hereby respectfully requests reconsideration of the application.

### **OBJECTION TO THE CLAIMS**

Claims 8-12, 20-24, and 31-35 were objected to as being dependent upon a rejected base claim, but would be allowable if re-written in independent form including all of the limitations of the base claim and any intervening claims.

Applicant has amended Claims 8, 20, and 31 to put them in independent form to include all of the limitations of their base claim. Therefore, Applicant submits that independent Claims 8, 20, and 31 are allowable. Because Claims 2-7, 9-12, 14-19, 21-24, 26-30, and 32-35 depend from allowable independent claims, they are allowable for the same reasons that make their corresponding independent claims allowable.

## **CONCLUSION**

Applicant respectfully submits that all of the claims of the pending application are now in condition for allowance over the cited references. Accordingly, Applicant respectfully requests withdrawal of the rejections, allowance, and early passage through issuance. If the Examiner has any questions, the Examiner is invited to contact the Applicant's agent listed below.

Respectfully submitted,

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